

What is claimed is:

1. A control system for a compression ignition internal combustion engine, for causing a mixture supplied to the engine to burn within a combustion chamber by self-ignition, comprising:

operating condition-detecting means for detecting operating conditions of the engine;

residual combustion gas amount-determining means for determining an amount of residual combustion gas depending on the detected operating conditions of the engine;

combustion gas retention means for retaining part of combustion gas in the combustion chamber after combustion, based on the determined amount of residual combustion gas;

supercharging means for supercharging fresh air flowing to the combustion chamber;

supercharging execution-judging means for judging, based on the detected operating conditions of the engine, whether or not the supercharging by said supercharging means should be executed so as to cause self-ignition; and

supercharging control means for causing said supercharging means to supercharge the fresh air flowing to the combustion chamber when it is judged by said supercharging execution-judging means that the supercharging should be executed.

2. A control system according to claim 1, wherein said supercharging execution-judging means judges that the supercharging by said supercharging means should be executed when the determined amount of residual combustion gas is equal to or larger than a

predetermined value.

3. A control system according to claim 1, wherein said supercharging control means sets supercharging pressure created by said supercharging means to a larger value as the determined amount of residual combustion gas is larger.

4. A control system according to claim 1, wherein said operating condition-detecting means includes engine speed-detecting means for detecting engine rotational speed and accelerator opening-detecting means for detecting accelerator opening, and wherein said supercharging execution-judging means judges whether or not the supercharging by said supercharging means should be executed, based on a map in which predetermined values of the amount of residual combustion gas are set with respect to required load on the engine dependent on the accelerator opening and the engine rotational speed, and the engine rotational speed.

5. A control system according to claim 1, wherein the engine includes an exhaust valve, and wherein said combustion gas retention means retains the part of combustion gas in the combustion chamber by advancing valve-closing timing of the exhaust valve.

6. A control system according to claim 1, wherein the engine includes a plurality of exhaust valves, and wherein said combustion gas retention means retains the part of combustion gas in the combustion chamber by opening at least one of the exhaust valves during an intake stroke to thereby draw exhaust gases into the combustion chamber.

7. A method of controlling a compression ignition internal combustion engine, to cause a mixture

supplied to the engine to burn within a combustion chamber by self-ignition, comprising:

a detecting step of detecting operating conditions of the engine;

a determining step of determining an amount of residual combustion gas depending on the detected operating conditions of the engine;

a retaining step of retaining part of combustion gas in the combustion chamber after combustion, based on the determined amount of residual combustion gas;

a judging step of judging, based on the detected operating conditions of the engine, whether or not supercharging of fresh air flowing to the combustion chamber should be executed so as to cause self-ignition; and

a control step of providing control such that the supercharging is executed when it is judged in said judging step that the supercharging should be executed.

8. A method according to claim 7, wherein said judging step includes judging that the supercharging should be executed when the determined amount of residual combustion gas is equal to or larger than a predetermined value.

9. A method according to claim 7, wherein said control step includes setting supercharging pressure to a larger value as the determined amount of residual combustion gas is larger.

10. A method according to claim 7, wherein said detecting step includes detecting engine rotational speed and accelerator opening, and wherein said judging step includes judging whether or not the supercharging should be executed, based on a map in which predetermined values of the amount of residual

combustion gas are set with respect to required load on the engine dependent on the accelerator opening and the engine rotational speed, and the engine rotational speed.

11. A method according to claim 7, wherein the engine includes an exhaust valve, and wherein the retention step includes retaining the part of combustion gas in the combustion chamber by advancing valve-closing timing of the exhaust valve.

12. A method according to claim 7, wherein the engine includes a plurality of exhaust valves, and wherein said retention step includes retaining the part of combustion gas in the combustion chamber by opening at least one of the exhaust valves during an intake stroke to thereby draw exhaust gases into the combustion chamber.

13. An engine control unit including a control program for causing a computer to control a compression ignition internal combustion engine, to cause a mixture chamber by self-ignition, wherein the engine to burn within a combustion chamber by self-ignition,

to detect operating conditions of the engine, determine an amount of residual combustion gas depending on the detected operating conditions of the engine, cause part of combustion gas to be retained in the combustion chamber after combustion, based on the determined amount of residual combustion gas, judge, based on the detected operating conditions of the engine, whether or not supercharging of fresh air flowing to the combustion chamber should be executed so as to cause self-ignition, and provide control such that the supercharging is executed when it is judged that the

supercharging should be executed.

14. An engine control unit according to claim 13, wherein when the control program causes the computer to judge whether or not the supercharging should be executed, the control program causes the computer to judge that the supercharging should be executed when the determined amount of residual combustion gas is equal to or larger than a predetermined value.

15. An engine control unit according to claim 13, wherein when the control program causes the computer to provide control such that the supercharging is executed, the control program causes the computer to set supercharging pressure to a larger value as the determined amount of residual combustion gas is larger.

16. An engine control unit according to claim 13, wherein when the control program causes the computer to detect operating conditions of the engine, the control program causes the computer to detect engine rotational speed and accelerator opening, and the control program causes the computer to judge whether or not the supercharging should be executed, based on a map in which predetermined values of the amount of residual combustion gas are set with respect to required load on the engine dependent on the accelerator opening and the engine rotational speed, and the engine rotational speed.

17. An engine control unit according to claim 13, wherein the engine includes an exhaust valve, and wherein the control program causes the computer to cause the part of combustion gas to be retained in the combustion chamber by advancing valve-closing timing of the exhaust valve.

18. An engine control unit according to claim 13,

wherein the engine includes a plurality of exhaust valves, and wherein the control program causes the computer to cause the part of combustion gas to be retained in the combustion chamber by opening at least one of the exhaust valves during an intake stroke to thereby draw exhaust gases into the combustion chamber.